

# HEALTH PRODUCTS BASED ON JERUSALEM ARTICHOKE AND INDICATORS OF ITS QUALITY

Monograph



IRYNA R. BILENKA

NATALIA A. LAZARENKO





MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE

ODESA NATIONAL UNIVERSITY OF TECHNOLOGY

IRYNA R. BILENKA  
NATALIA A. LAZARENKO

**HEALTH PRODUCTS BASED ON JERUSALEM ARTICHOKES  
AND INDICATORS OF ITS QUALITY**

Monograph

Odesa 2022

UDC 613.292:635.24:005.336.3  
B 58

Authors:

Iryna Remivna Bilenka, PhD  
Natalia Anatoliivna Lazarenko, PhD

Reviewers:

V.V. Poharska, Tech. Dr., Prof., Laureate of the State Prize in Science and Technology, Kharkiv State University of Food Technology and Trade, Head of the Department of Food Technology Products from Fruits, Vegetables and Milk and Innovations in Healthy Nutrition;

A.T. Bezusov, Tech. Dr., Prof., Odesa National University of Technology, Prof. of the Department of Bioengineering and Water;

T.Iu. Sutkovych, PhD, Assoc. Prof., Poltava University of Economics and Trade, Assoc. Prof. of the Department of Technology of Food Production and Restaurant Business.

*Recommended for publication by the Academic Council*

*of Odesa National Academy of Food Technologies\**

*(protocol №11 of 05. 04.2022)*

*\* Odesa National University of Technology*

*(formerly Odesa National Academy of Food Technologies)*

I.R. Bilenka

B 58 Health products based on Jerusalem artichokes and indicators of its quality: monograph / I.R. Bilenka, N.A. Lazarenko. — Odesa: NNVK "ATB", 2nd ed., rev. and suppl., 2022. — 124 p.

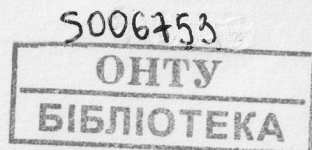
ISBN 978-966-2042-50-8

This monograph includes scientifically sound technologies for the manufacture of fermented juices and paste-like products based on Jerusalem artichokes, allows to expand the range of health and functional foods for restaurants, including food networks of sanatoriums, preventive clinics, SPA-centers, etc. The information on the current state of manufacture of health products, classification of fermented products is presented; the fermentation process of Jerusalem artichoke tubers was studied; the formulated ratios of the components of fermented juices and paste-like products based on Jerusalem artichokes have been developed; the indicators of quality and safety of developed products are determined.

UDC 613.292:635.24:005.336.3

ISBN 978-966-2042-50-8

© I.R. Bilenka, N.A. Lazarenko, 2022



## Contents

Introduction .....	5
Section 1. Current state of the manufacture of health products .....	7
1.1. Analysis of the traditional range of health products .....	7
1.2. Production of fermented health foods based on lactic acid fermentation.....	10
Section 2. Jerusalem artichokes as a promising raw material for the manufacture of health products .....	18
2.1. Characteristics of the chemical composition of Jerusalem artichokes.....	18
2.2. Health properties of Jerusalem artichokes.....	24
2.3. Manufacture of fermented health products based on Jerusalem artichokes.....	31
2.4. Types of lactic acid bacteria suitable for the manufacture of fermented products based on Jerusalem artichokes.....	32
Section 3. Characteristics of raw materials and research of the processes of its preparation for fermentation .....	35
3.1. Justification for the choice of the main and auxiliary raw materials.....	35
3.2. Determination of optimal microwave processing parameters .....	41
3.3. Study of the effect of microwave processing parameters on the content of L-ascorbic acid, phenolic compounds and of polyphenol oxidase activity .....	44
Section 4. Research of the process of obtaining fermented products based on Jerusalem artichokes .....	46
4.1. Study of the fermentation process of Jerusalem artichokes.....	46
4.2. Study of influence of the composition of plant substrate and lactic acid bacteria on the fermentation process.....	52
4.3. Changes in the chemical composition of vegetables during the fermentation.....	60
4.4. Influence of technological factors on the manufacturing process of fermented products based on Jerusalem artichokes .....	64



4.4.1. Study of the freezing process in obtaining concentrated fermented Jerusalem artichoke juice .....	64
4.4.2. Study of the crushing process in obtaining pasty products based on fermented Jerusalem artichoke pomace.....	71
<b>Section 5. Development of scientifically sound manufacturing technology of fermented products based on Jerusalem artichokes.</b>	<b>77</b>
5.1. Development of technology for manufacturing fermented juices and pasty products based on Jerusalem artichokes.....	77
5.2. Development of prescription ratios of the components of fermented juices and pasty products based on Jerusalem artichokes ..	86
5.3. Selection of thermal sterilization mode of pasty products.....	94
<b>Section 6. Research of the quality and safety indicators of developed juices and pasty products based on fermented Jerusalem artichokes .....</b>	<b>100</b>
<b>Conclusion .....</b>	<b>104</b>
<b>References .....</b>	<b>106</b>

## INTRODUCTION

The monograph presents the results of our own research on scientifically sound development of the manufacturing technology of fermented products based on Jerusalem artichokes and expanding the range of health foods; the work characterizes the expediency of Jerusalem artichoke fermentation process in the manufacture of health foods; the developed low-waste technology of fermented Jerusalem artichoke processing is presented; the characteristic of the influence of a microwave processing mode on experimental raw materials which is used for the purpose of inactivation of the enzyme of polyphenol oxidase is given.

The influence of prescription structure components on organoleptic quality indicators of the developed products is presented in the monograph at the development of a compounding ratio; the optimization of prescription components of the developed range of health food products such as juices and pastes and determination of quality and safety indicators of the developed products is presented.

The nutrition is the most important of all the human physiological needs. The human body comes into close contact with all the chemicals of plant and animal origin with the help of such an environmental factor as food. Absolutely all the vital functions of the body are closely related to nutrition. It is the main factor in ensuring the development and continuous renewal of all the cells and tissues of the body, it determines the flow of energy needed to restore the body's energy expenditure both at rest and during exercise.

Various enzymes, hormones, and other regulators of metabolic processes are formed from a single source, which is food. The metabolism, which determines all the life processes of the organism, directly depends on the nature of nutrition.

Therefore, one of the important factors determining the health of the population is proper nutrition, regardless of the seasonality of raw materials received. Today, the food industry of Ukraine practically does not manufacture fermented products for long-term storage, except for a



limited range of pickled vegetables and fruit. At the same time, the fermented products have antioxidant, anticancer, and probiotic properties and protect people from diseases of civilization.

The study, development and manufacture of products obtained by fermentation of raw materials made by lactic acid bacteria are of interest. These microorganisms have a high metabolic activity, participate in the synthesis of vitamins, hydrolysis of bile salts and cholesterol, have an antagonistic effect against opportunistic and pathogenic microflora, have a beneficial effect on digestion and eliminate dysbiotic disorders.

Owing to good taste, dietary and health properties, the fermented products are in high demand among the population.

Due to its unique chemical composition, Jerusalem artichoke tubers have a positive effect on the human body, healing it. They accumulate almost no nitrates, heavy metals and radionuclides, contain fiber, pectin, organic acids, proteins, essential amino acids and vitamins. In addition, Jerusalem artichokes are a promising raw material for the canning industry, as the products based on it can be manufactured in the autumn-winter period, which eliminates the seasonality of most enterprises. So research aimed at creating new fermented foods based on Jerusalem artichokes with pre- and probiotic properties are of theoretical and practical interest today.

The monograph is intended for specialists of the food industry, researchers engaged in the development of health food, for students of higher education institutions in the specialty 181 "Food Technology" for EPP (Educational and Professional Programs) such as "Restaurant Technologies of Healthy Eating", "Healthy Food Industry", "Technology of Restaurant Business", and "Innovative Technologies of Restaurant Business".

## Section 1. Current state of the manufacture of health products

### 1.1. Analysis of the traditional range of health products

Providing the population with high-quality food is one of the difficult problems facing the state. When solving it, the important role is given to the canning industry. The manufacture of the products of high nutritional and biological value, which will provide the human body during the year with necessary components to maintain vitality and efficiency is of particular importance. The health food products can be confidently attributed to such products. A significant role in solving this problem is given to the development of technologies for processing fruits and vegetables, expanding its range, improving quality, and rational use of production capacity.

The term "health nutrition" originated in 1992 at the International Conference in Rome and symbolizes the beginning of a new direction in the system of health and preventive treatment [41,45,48,162].

According to the international classification, depending on the microflora restoring method, it is customary to distinguish between products of probiotic, prebiotic, and synbiotic orientation [49, 56].

The probiotic products have a special place in the development of health food products, as these contain live microorganisms, food additives of microbial origin, which show its positive effects on the body through the regulation of intestinal microflora [8,24].

The following microorganisms are used for the preparation of probiotics: *Bacillus subtilis*; *Bifidobacterium adolescentis*, *Bifidobacterium bifidum*, *Bifidobacterium breve*, *Bifidobacterium infantis*, *Bifidobacterium longum*; *Lactobacillus acidophilus*, *L.casei*, *Lactobacillus delbrueckii* subsp. *bulgaricus*, *L.helveticus*, *L.fermentum*, *L.lactis*, *L.rhamnosus*, *L.plantarum*; *Propionibacterium*; *Saccharomyces boulardii*; *S.cremoris*, *S.lactis*, *Streptococcus salivarius* subsp. *thermophilus*, etc. [149].

Currently, the microorganisms used as probiotics are classified into four main groups:



This monograph includes scientifically sound technologies for the manufacture of fermented juices and paste-like products based on Jerusalem artichokes, allows to expand the range of health and functional foods for restaurants, including food networks of sanatoriums, preventive clinics, SPA-centers, etc. The information on the current state of manufacture of health products, classification of fermented products is presented; the fermentation process of Jerusalem artichoke tubers was studied; the formulated ratios of the components of fermented juices and paste-like products based on Jerusalem artichokes have been developed; the indicators of quality and safety of developed products are determined.



Iryna Bilenka - Candidate of Technical Sciences, Doctor of Philosophy, Associate Professor at the Technology of Restaurant and Health Food Department of the Odesa National University of Technology, author of more than 150 scientific and scientific-methodical works, including 18 copyright certificates and patents, textbook, 5 teaching aids, 2 monographs. Scientific interests: technologies of functional food products, health and preventive products, quality control and food safety.



Natalia Lazarenko - Candidate of Technical Sciences, defended a dissertation on the topic «Development of technology for fermented products based on Jerusalem artichoke». Since 2013, she has been working at the Technology of Restaurant and Health Food Department of the Odesa National University of Technology. Scientific interests: healthy food products, fermented products, technologies for processing Jerusalem artichoke tubers.